

## COORDINATED AUDIO/ VISUAL OMNIDIRECTIONAL RECORDING

### CROSS REFERENCE TO EARLIER FILED APPLICATIONS

This application is a non-provisional application of provisional application 60/231,513 filed 09/09/00 from which priority is claimed.

### FIELD OF THE INVENTION

This invention relates to simultaneous recording of panoramic visual data and panoramic audio data and the application of the directed audio (or radiated) signal to focus the visual recording on the source of the directed audio signal particularly as it applies to a teleconferencing situation.

### BACKGROUND AND INFORMATION DISCLOSURE:

The use of video photography has evolved steadily over the past forty years in its application to surveillance situations and environments. Applications include stationary systems such as are found in commercial establishments, and on moving bases such as robots, on submarines, vehicles, etc.

For example, U.S. Patent 6,016,385 to Yee et al discloses a real time remotely controlled robot having a head with a pair of television cameras (eyes) and a pair of microphones (ears) and a pair of arms mounted on a mobile trunk. An operator located at a command center receives audio and visual signals from the robot and, in response, issues commands that control movement of the trunk and arms to perform tasks.

U. S. Patent 4,453,085 to Pryor discloses an electro-optical system for monitoring the positioning of a movable arm.

U. S. Patent 4,604,559 To Hawkes et al discloses a robot controlled by a user wherein an audio signal is fed back from the robot to the user regarding force and movement parameters of the robot operation.

U. S. Patent 5,299,288 to Glassman et al discloses an image directed robot system for surgical applications including an optical tracking camera supplying data to the controlling processor.

One of the major developments in video photography in recent years has been the panoramic camera. According to this technology a lens with a 360° field of view stores the entire field in memory and various areas are selected and projected according to the interests of the viewer. This technique has many applications, for example, in real estate advertisements where features of the location are selected and enlarged for detailed examination by the viewer.

U.S. Patent 5,920,337 to Glassman et al discloses an omnidirectional visual image detector and processor (incorporation herein by reference). There is described a reflective round lens (either a cone or spherical section) which reflects the object beam from a surrounding view (encircling the lens) to a direction parallel to the axis of the rotund lens. The beam then passes through an objective lens and is focussed onto a CCD (charge coupled device) where image data is detected and processed for storage or image presentation on a monitor.

In the context of this specification, the term, "visually examine" means that, a narrow field of view is selected covering a few degrees from an entire 360° field of view recorded by a panoramic video camera.

Meetings of groups of people for verbal exchange of information , etc., is an important activity in current business practice, in entertainment (talk shows), seminars, etc. The ideal arrangements for such gatherings is to have the attendees sitting around a conference table . Not only does the conference table geerate an intimate atmosphere, but the table is a common surface where the attendees can spread various documents which are the subject of the discussion. Many of these meetings are televised. The task of setting up unidirectional cameras at the right location and, when more than one camera is used, to switch back and forth between cameras as first one attendee then another, etc., speaks.

## SUMMARY

This invention is a system for presenting selected scenes from a video camera having a 360°field of view wherein the xscenes are selected by sounds such as a voice originating at the scene.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a teleconferencing system characterizedas close proximity of attendees.

Fig. 2 shows a teleconferencing system which is voice controlled.

Fig. 3 shows a teleconferencing system which is controlled. by a moderator.

Fig. 4 shows a teleconfering system where the televewing follows an object.

Fig. 1 shows this invention` directed toward a teleconferencing system having a omnidirectional video camera station 10 in a central location arranged to communicate by infra red radiation with any selectable transmitter station 20(conference attendees)which is one an array of transmitter stations 20 arranged around the camera station 10.

Fig. 2 shows one transmitter station 20 including a microphone 12, a signal generator 14 coupled to a memory address 16. The generator 14 generates a carrier signal modulated by the transmitter address. The transmitter station 20 also has an IR transmitter 18 for broadcasting the address modulated signal to the camera station. The camera station 10 has an omnidirectional video camera 22, and IR receiver 24 for receiving the IR carrier signal from the transmitter station 20. The users voice is transmitted as a voice signal sent directly to the omnidirectional camera 22 where it is recorded by an audio detector 26 part of the camera 22. The IR address signal is transmitted to the camera providing that the camera 22 is notified as to the address of the speaker. The camera 22 locates and records the address as part of the video signal and stores the video recording in the video memory 28. A video controller 30 residing with the camera 22 displays that section of the panoramic view on monitor 32 which represents the origin of the audio signal. When the video recording is displayed on monitor 32, the video controller 30 reading the instant address on the video recording, displays the scene corresponding to the recorded address.

Fig. 3 shows another embodiment wherein the address signal is generated by a host moderator who has an address selector 34 with a list of the addresses of all the

transmitter stations 20 so that he can select the address of the speaker or any other member of the audience according to his desire by operating the keyboard of his address selector.

34.

In a playback mode, the address selector is s the recording is being played back by the viewer who can press the button corresponding to an attendee to study the reaction of

various attendees to the words of the speaking attendee.

In another embodiment, where the group is very large, so that direct transmission of the audio signal by air coupling is impractical, the voice signal modulates an IR carrier signal directed to a receiver at the camera. The carrier signal is also modulated by the unique address of the local transmitter. The address modulation is a high frequency (higher than the audio range) of the carrier so that the high frequency address signal can be separated from the low frequency audio signal after detection by the IR receiver by a high band pass filter in parallel with a low bandpass filter. .

Fig. 4 shows still another embodiment which applies to a situation where it is required to maintain automatic surveillance of an object 46 (person, dog, ship, one or more athletes engaged in a team sport).

A central receiving system has a remote receiver 40 spaced from a camera receiver 42 located with camera 44 at a known distance  $D$ . The accuracy of the system is increased in

proportion to the distance between the remote receiver 40 and the camera receiver 42

A remote oscillator 48 and camera oscillator 50 each generate a carrier signal  $f$ . The remote receiver 40 receives the carrier signal from the camera oscillator 50 with which it is synchronized using a phase locked loop 52. The object has an oscillator 54 oscillating at the carrier frequency  $f$ . The object oscillator 54 is synchronized with the camera carrier signal when the object is at a 'zero' position proximal to the camera oscillator. Initialization is done with a phase locked loop located with the object. The object oscillator 54

broadcasts the carrier signal back to a camera receiver 42 and a remote receiver 40. When the object 60 is displaced from both the camera receiver 42 and the remote receiver 40, a phase detector 64 located with the camera and another phase detector 66 located with the remote station measure the phase shift of the signal received from the object with respect to the signals generated by the camera oscillator and the remote oscillator, respectively. Computer 68 is programmed to calculate the distances from the object to the camera and remote receiver from the respective phase shifts. The distance calculations are used together with the distance  $D$  between camera 64 and remote station to calculate the direction from the camera to the object, so that a final direction signal is obtained. The direction signal is the direction of the object relative to the camera, and is stored with the rest of the video data